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1S1b Models and tools for estimating circularity of alternative food and agricultural systems

Tailor made solutions for regenerative agriculture in a circular food vision: a case-study of a Dutch dairy farm

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Agricultural land which is managed properly can provide ecosystem services and contribute positively to the environment. Within agricultural land, many of these ecosystems services are mediated in the soil: primary productivity, climate regulation, nutrient cycling, water purification and regulation, biodiversity and habitat provision. We are therefore in need for a regenerative and circular mode of agriculture that uses soil conservation as the entry point to regenerate and contribute to multiple ecosystem services, with the aspiration that this will enhance not only the environmental, but also the social and economic dimensions of sustainable food production. For a regenerative and circular farming approach to be meaningful for individual farms, we are in need of methods that can give insight in the efficacy of practices in delivering on multiple regenerative and circular objectives within local contexts. We, therefore, created a modelling approach which allowed the ex-ante design and assessment of management practices for individual farm types and pedo-climatic conditions. Within this modelling approach we used two multi-objective models (the Soil Navigator and FarmDESIGN) together to take into account soil dynamics at the field scale and environmental and socio-economic outcomes at farm scale. Using a case-study of a Dutch dairy-farm we found that our models can be used to translate the broad objectives of regenerative and circular agriculture into pragmatic sets of farm practices, customized for individual farms. Combining the Soil Navigator with FarmDESIGN allowed us to use soil management practices as the basis for optimizing the overall socio-economic and environment sustainability of our case-study farm, very much in line with the definition of RA within a circular food vision. At the same time, multi-objective optimization of FarmDESIGN showed that even for an individual farm there are multiple viable reconfigurations. While this study showed a successful first application of combining models together to assess

and redesign farms towards regenerative and circular agriculture, further development is essential to widen the applicability of this study to include emerging farm types and indicators of sustainability that operate over a longer time period.

Keywords: regenerative agriculture, farm assessment and redesign, soil health, farm sustainability